

immediately iced and transported using an ice box within 2 hours to the area for drying. Raw anchovy samples were cleaned, carefully washed with potable water and drained. Fish samples were mixed thoroughly with dry salt (20% w/w) and subjected to drying

SOLAR DRYING PROCESS OF ANCHOVY IN THE FABRICATOR

Limitations of sun drying can be improved by raising the drying fish rack off the ground on wooden frames which allows air to circulate in all the directions, that facilitates water evaporation from both sides (Sankat and Mujiaffar, 2004).

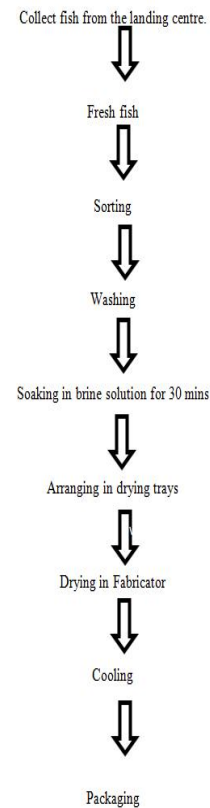
Solar drying is an improved method of sun drying. It minimizes or stops some of the limitations of open sun drying (FAO, 1981; Relekar et al., 2014). Solar drying differs from open sun drying in a structure, often very simple in construction, which is used to enhance effect of the insulation (Yu, Siaw, and Idrus, 1982).

Bereket Abraha et al., (2017) have researched and reported the quality of the fish products dried in the solar tent drier was superior compared to that of open sun rack-dried products. Based on this a drier was fabricated for the drying process of anchovies as shown in Fig....



Figure 6 SOLAR DRYER

DEHYDRATION METHODOLOGY



The drying process was done for 10 days to obtaining the fine dried fish)

Figure 7 DRIED ANCHOVY



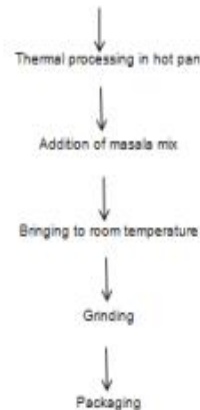
Figure 8 PREPERATION OF ANCHOVY POWDER

PREPARATION OF PRODUCT MIX

1. **Preparaion of Anchovy Powder**
2. **Preparation of control chutney Powder**

PREPERATION OF THE ANCHOVY POWDER

Remove the inedible portion (head and tail) from the dried fish



PREPERATION OF IDLY CHUTNEY POWDER

Ingredients:

- Urad dhal
- Toor dhal
- Red chilly
- Curry leaves
- Sesame seeds
- Garlic
- Salt
- Dried anchovy

After numerous improvisations from the above ingredients, the chutney powder was made for 100gm.

The product mix was prepared with **one control** and **Three Test samples** in

RTE CURRY POWDER				
Ingredient	Control	Trial 1	Trial 2	Trial 3
Urad Dhal (g)	65.0	62.5	60.5	60.5
Thoor Dhal (g)	23.5	20.5	20.0	17.5
Salt (g)	1.0	0.50	0.50	0.50
Spice powder mix (g)	11.5	11.5	11.5	11.5
Anchovy powder (g)	-	5.0	7.5	10
Total (g)	100	100	100	100

Different Concentrations

PRODUCT MIX FORMULATION TABLE 2- FORMULATION OF PRODUCT MIXES

Figure 9 FORMULATED PRODUCT



The prepared product was packed in a sterile glass container and stored at room temperature, in a dark place away from the sun light.

PHASE - III SENSORY EVALUATION OF THE PRODUCT FOR ITS APPECTANCE

Food sensory testing involves the use of the human senses in the objective evaluation of food products. Characteristics such as appearance, texture, odour and taste are analysed by trained testers to assess product quality or derive opportunities for improvement.

The sensory evaluation of Nutrient Enrichment of RTE Chutney Powder was done on 07.01.2023 with a five point Hedonic scale to test the various parameters such as taste, texture, aroma, appearance and overall acceptability.

The sensory evaluation of this product was carried out by 30 semi-trained panellists comprising of students who have previous experience in sensory evaluation of food products.

The order in which participants tasted the samples was not controlled.

SENSORY EVALUATION



Figure 10 SENSORY EVALUATION

SENSORY CARD:

Date: _____

Name: _____

Hi, I am Jeremiah Pandian J.S, senior year student pursuing MSc. Food Chemistry and Food Processing, from Loyola College. This survey is for the sensory evaluation of "Nutrient Enrichment of traditional RTE Chutney Powder using Anchovy," incorporated with different concentrations of Anchovies, as a part of my research project.

Please evaluate the coded samples for each sensorial parameter including color, aroma, texture, flavor, and overall acceptance based on your degree of liking.

(1 = dislike very much; 2 = dislike slightly; 3 = neither like nor dislike; 4 = like slightly; 5 = like very much).

Note:-

*** **SEAFOOD ALLERGEN WARNING** This is a non-vegetarian food product and people who are sensitive to Fish and fish food products are kindly requested to refrain from tasting the samples.

SAMPLE	TASTE	TEXTURE	AROMA	APPEARANCE	OVERALL ACCEPTABILITY
A					
B					
C					
D					

Thank you for your feedback.

S.no	Parameters	Test method
1	Moisture content	IS 11536 (2007)
2	Fat content	IS 1153:1992, IS 12711
3	Protein	IS 6287
4	Total Ash	IS 1797:1985
5	Omega 3 fatty acid	RVNL/SOP/073

PHASE IV – ANALYSIS FOR PROXIMATE COMPOSITION OF THE MIX AND ITS OMEGA FATTY ACID CONTENT LABORATORY TESTING

PROXIMATE ANALYSIS: The value incorporated RTE Powder was subjected to proximate analysis to determine its nutrient composition, namely moisture, fat, protein and ash using approved method as mentioned below:

TABLE-3 LABORATORY TEST AND METHODS

MOISTURE CONTENT

IS 11536 (2007): Processed - Cereal based complementary foods - Specification (Second Revision)

The method is based on removing soil moisture by oven-drying a soil sample until the weight remains constant. The moisture content (%) is calculated from the sample weight before and after drying.

FAT CONTENT TEST

Simple extraction method

Dissolve 10 g sample in 10 mL of warm water and introduce into Mojonnier fat extraction tube or similar apparatus. Add 25 mL peroxide free diethyl ether. Cork the tube and shake vigorously for 1 minute. Add 25 mL of petroleum ether and shake vigorously for 30 seconds. Let it stand for 30 minutes or until separation is complete. Draw off the fat solution into a suitable flask (previously dried at 100°C, cooled and weighed). Repeat the extraction and subsequent operations twice more. Evaporate the ether

and dry the fats for 1 hour at 100°C. Cool and weigh.

Calculation:

$$\text{Fat percent by mass (dry basis)} = \frac{M1}{M2 \times (100 - M)}$$

M1 - mass in g of extracted fat

M2 mass in g of the prepared sample taken,

M = percentage of moisture in the material

TEST FOR PROTEIN

The assembly consists of a round bottom flask A of 1000 ml capacity fitted with a rubber stopper through which passes one end of the connecting bulb tube B. The other end of the bulb B is connected to the condenser C which is attached, by means of a rubber tube, to a dip tube D which dips into a known quantity of standard sulphuric acid contained in a beaker E of 250 ml capacity.



Figure 11 PANELISTS PERFORMING SENSORY EVALUATION

Figure 12 APPARATUS FOR PROTEIN TEST

TOTAL ASH

Principle involved is that when a known weight of feed is ignited to ash, the weight of ash thus obtained is expressed in terms of percentage.

Procedure

Find out the weight of a clean dry crucible. Place about 2 g of sample and weigh this to find out accurate weight of the sample taken. Carefully place the weighed crucible over electric burner. The crucible should be partially opened. The sample will get charred with initial expulsion of smoke. Place the crucible in a muffle furnace and heat to 600°C. Keep it for 2 hours. At this temperature all organic matter will be burnt leaving behind minerals. Remove the crucible from the furnace carefully and cool it in a desiccator to room temperature and weigh again.

TOOLS USED FOR STATISTICAL ANALYSIS

- For determining the significant difference between the groups of samples one way Anova, SPSS Software was used by the Researcher.
- For doing the comparison studies t-Test; two samples assuming equal variables, Microsoft Excel.v2010 software was used by the Researcher.

CHAPTER – V

If a tasty new product of idli podi enriched with nethili is available would you buy it and eat it with idli and dosa?
81 responses

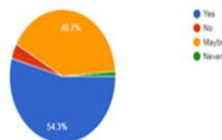


Figure 16 Q – RESULT D

RESULTS AND DISCUSSION:

The study on **Enrichment of Traditional Chutney Powder Using Anchovies** was carried out in a well-designed manner to meet the objective. The ready to eat chutney powders were prepared and evaluated, and the results are presented and discussed in this section

PHASE-1

The response to the E survey are summarised and recorded below:
The consumer's likings on seafood incorporated chutney powders was obtained from 100 respondents.

DEMOGRAPHIC DETAILS:

A total of 100 responds was collected,
51- Females and 49-males,
Age category: 18-23 yrs.

Preference of Seafood
Are you a fan of seafood and is it one of your favorite and preferred non-vegetarian foods?
100 responses

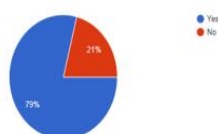


Figure 13 Q – RESULT A

79% of respondents responded 'yes' for seafood being their non vegetarian food

preference and 21% respondents responded 'No' for the question.

Figure 14 Q – RESULT B

56% of respondents relish Nethili fish and 25% were not sure and only 19% do not like the fish.

Figure 15 Q – RESULT C

Have you ever tried eating idli or a dosa with fish curry?
81 responses



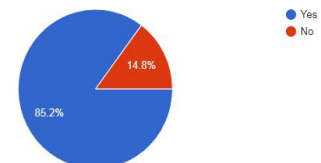
82.7% respondents has tried eating idlis with fish curry and 17.7% has not tried.

Figure 16 Q – RESULT D

54.3 % responded yes they will buy a new product that is enriched with anchovies and 45.7 said maybe. This reveals there is a high preference for consumers liking if this formulated product with anchovies is made available in the market.

Figure 17 Q - RESULT E

Would you rather have idli podi alongside idli or dosa?
81 responses



A Yes or No question was asked to the respondents whether they would have idli podi alongside with idli or dosa, 85.2% said yes and 14.8% said no for the question.

Figure 18 Q- RESULT F

Regarding the frequency of consuming chutney powder, 65.4% responded sometimes, 17.3% responded often, 7.4% responded regularly and 9.9% responded never.

ently do you have idli podi?

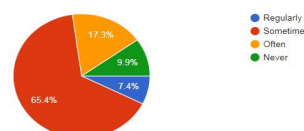
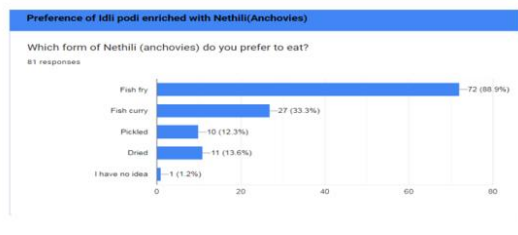


Figure 19 Q- RESULT G

From the following question 'which form of



Nethli (anchovies) do you prefer to eat? Most of respondents preferred it in the fried form. Since the question was an open ended question the respondents were allowed to select more than one option among that they preferred Fish fry the most followed by Fish curry, Pickled and Dried.

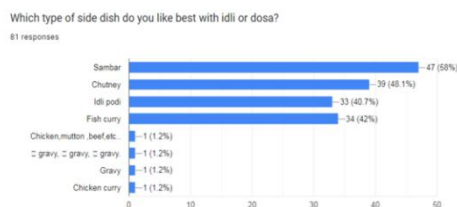


Figure 20 Q – RESULT H

Multiple preferences and choices were given to respondents and it resulted in the following observation. 58% preferred sambar, 48% chutney, 40.7% preferred idli podi, 34% fish curry, 1.2% chicken, mutton, beef, ect. Gravy - 1.2%, Chicken curry - 1.2%.

Figure 21 Q- RESULT I

For the question 'would you buy the product even if it is slightly costly' 56% respondents responded 'yes' they will buy the product even if it is costly. 33% responded 'maybe' they will buy or not buy the product and 9.9% responded 'No'.

CONCLUSION OF E-SURVEY

According to the data collected from the E Survey, 95% of people are willing to buy the new product formulated with anchovies, and 90.01% are willing to buy the product even if it is slightly more expensive, the survey also shows the influence of non-vegetarian foods predominantly liked by many non-vegetarian consumers compared to vegetarian foods. For most the consumers, purchase of non-vegetarian products were on a weekly basis. Kumar, N., and Kapoor, S. (2014).

85.2% of the respondent responded that they consume chutney powder with the

traditional breakfast. This E survey gives us an overall positive picture with regard to utilising the idli podi and proceeding to **Enrich the Traditional Chutney Powder Using Anchovies.**

RESULT OF PHASE II – PRODUCT MIX

Figure 22 FORMULATED PRODUCT IN A GLASS CONTAINER

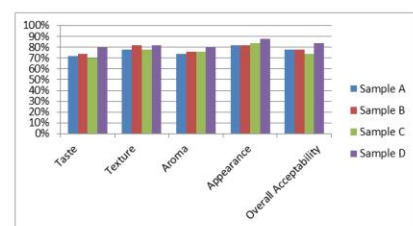
PRODUCT MIX FORMULATION

One control and three test samples with different proportions of anchovy powder (5%, 7.5% and 10 %) was formulated and prepared.



RESULT OF PHASE III – SENSORY EVALUATION

Sensory evaluation plays a vital role in the assessment of acceptance of novel food products and preferences for different cuisines. This process provides significant and valuable information to the food-processing industries and food scientists regarding the sensory quality of food products. Sensory evaluation is a critical component to that process. Historically, sensory evaluation has often been associated with product experts, and later as a more passive member of the product development team. Currently, the new challenges facing the food industry are



progressively transforming sensory to a

more proactive role, responsible for generating new product ideas based on unique sensory properties or unique consumer segments identified only through sensory behaviour. Sidel, J. L., and Stone, H. (1993).

According to the data collected from the Sensory evaluation done by 30 sensory panelists, the Test-3 sample has secured an average of 82.8%, with an overall acceptability score of 84% and liked the most by the sensory panelist.

Figure 23 SENSORY EVALUATION GRAPH

Sample A-Control, Sample B- T1, Sample C-T3, Sample D-T3

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Taste	Between Groups	5.492	3	1.831	2.056	0.110
	Within Groups	103.300	116	.891		
	Total	108.792	119			
Texture	Between Groups	.692	3	.231	.375	0.771
	Within Groups	71.233	116	.614		
	Total	71.925	119			
Aroma	Between Groups	1.758	3	.586	.650	0.584
	Within Groups	104.567	116	.901		
	Total	106.325	119			
Appearance	Between Groups	1.292	3	.431	.749	0.525
	Within Groups	66.700	116	.575		
	Total	67.992	119			
Overall Acceptability	Between Groups	3.440	3	1.147	2.175	0.095
	Within Groups	61.142	116	.527		
	Total	64.581	119			

The overall acceptability score of Control was 4.1, Trial 1 was 4.1, T2 was 4.0, and T3 was 4.4.

TABLE – 4 RESULTS OF ONE WAY ANOVA FOR SENSORY EVALUATION

There is no significance variation in the sensory evaluation of RTE Curry powder between the samples. Since no statistical significance was observed among trial samples and all three are acceptable, Trial 3 with highest proportion of anchovy powder (10%) with an overall acceptability score of 4.4 was chosen for further analysis.

TABLE – 5 RESULTS OF LABORATORY ANALYSIS

S.no	Parameters	Units	Results Test samples/T3
1	Moisture	g/100g	5.60
2	Fat Content	g/100g	4.90
3	Protein	g/100g	20.90
4	Total Ash	%/100g	5.10
2	Omega 3 fatty acid	g/100g	1.1

The following are the results obtained from proximate analysis of the given ready to eat idly chutney powder.

The moisture content was **5.60 g/100g**. Low moisture content is desirable as its related to low water activity of powder,

which is important for powder stability during storage. (Abdullah, Z., 2020). Moisture, per cent by weight (not more than) 10.0 according FSSAI standards for powdered foods, thus the product is within the safety standards of FSSAI.

From the results obtained from the laboratory the fat content in the product was said to be **4.9g/100g**. The fat content in product is more or less the same in other Idli chutney powders which ranges from 4% - 12%. The fat content in the idly chutney powder basically due to lentils, chilly and anchovies added to it.

From the results obtained from the laboratory the protein content in the product was said to be 20.90 g/100g in the test sample. The protein content in the idli chutney powder was due to the protein available in pulses, chillies and curry , and anchovies. The protein content of anchovy ranged from 17.24 to 16.94%. Kaya, Y., and Turan, H. (2010).

From the results obtained from the laboratory the total ash content in the product was said to be **5.10 g/100g** in the test sample.

On laboratory analysis the Omega 3 fatty acid content of chutney powder with 10% anchovies powder (T3) was found to be **1.1g/100g**. Fish is healthy part of the human diet due to the high content of long chain n-3 polyunsaturated fatty acids (n-3 PUFA) as eicosapentaenoic acid (EPA, C20:5n-3) and docosahexaenoic acid (DHA, C22:6n-3). Di Bella, (2022). EPA and DHA are forming compounds of Omega 3 anchovy (*Stolephorus Sp.*) oil concentrate. Content analysis results, anchovy fatty acid 1% using spectrophotometer GC-MS. Previous research also states that the anchovy (*Stolephorus Sp.*) is a cheap local fishery products and very easy to find. Anchovy classified as oily fish contains high category of omega-3 fatty acids. (Mattimu, 2016).

SHELF LIFE STUDY AFTER 60 DAYS

TABLE - 6 RESULTS OF t-Test TWO SAMPLES ASSUMING EQUAL VARIANCE

t-Test: Two-sample Assuming Equal Variances						
Sensory Attributes	Min score	Max score	Mean	SD	T-value	P Value
Taste	A 1	5	3.786	0.686	8.231	0.000
	B 1	5	4.929	0.262	8.231	0.000
Texture	A 1	5	3.821	0.669	6.128	0.000
	B 1	5	4.75	0.44	6.128	0.000
Aroma	A 1	5	3.571	0.634	8.884	0.000
	B 1	5	4.821	0.39	8.884	0.000
Appearance	A 1	5	3.892	0.595	8.158	0.000
	B 1	5	4.692	0.314	8.158	0.000
Overall acceptability	A 1	5	3.75	0.518	9.972	0.000
	B 1	5	4.692	0.314	9.972	0.000

Shelf-life of food products can be regarded as the period of time during which a product could be stored until it becomes unacceptable from safety, nutritional, or sensory perspectives. Shelf-life estimation of food products and beverages has become increasingly important in recent years due to technological developments and the increase in consumer interest in eating fresh, safe and high quality products. The shelf-life of the majority of food products is determined by changes in their sensory characteristics. Giménez, A., Ares, F., and Ares, G. (2012).

Test of significance revealed that there is a significant difference in the mean Taste, Texture, Aroma, Appearance and Overall acceptability between the control and experimental samples. It is Evident the experiment sample had a higher mean compared to that of the control sample. It was observed through this study that the formulated chutney powder with 10 % anchovies was acceptable on sensory evaluation. Overall, the proximate analysis of the formulated powder is well balanced with all essential nutrients. Further the presence of anchovies add value to this product as they are nutrient rich fishes. Stored in glass containers the powder was shelf stable for 60 days.

SUMMARY

- It is concluded that consuming traditional RTE Chutney Powder using Anchovy will satisfy the Needs of fish lovers and will add variety and value to the existing RTE chutney powder on the market shelf.
- The E-survey conducted show the high preference and consumer liking for this formulated product if made available.
- The sensory acceptance of chutney powder with 10 % anchovies also scored well among the sensory panelists.
- The nutritional composition of RTE Chutney powder meets the FSSAI specification for moisture requirement for powdered food products.

- The presence of omega 3 fatty acids in this product plays as an essential component to tackle health hazards.
- The shelf life study proves that the product is stable and tasty even after 60 days in the shelf.

It was observed through this study that the formulated chutney powder with 10 % anchovies was acceptable on sensory evaluation. Overall, the proximate analysis of the formulated powder is well balanced with all essential nutrients. Further the presence of anchovies adds value to this product as they are nutrient rich fishes. Hence the product is safe for human consumption and has a good taste.

CHAPTER – VI

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